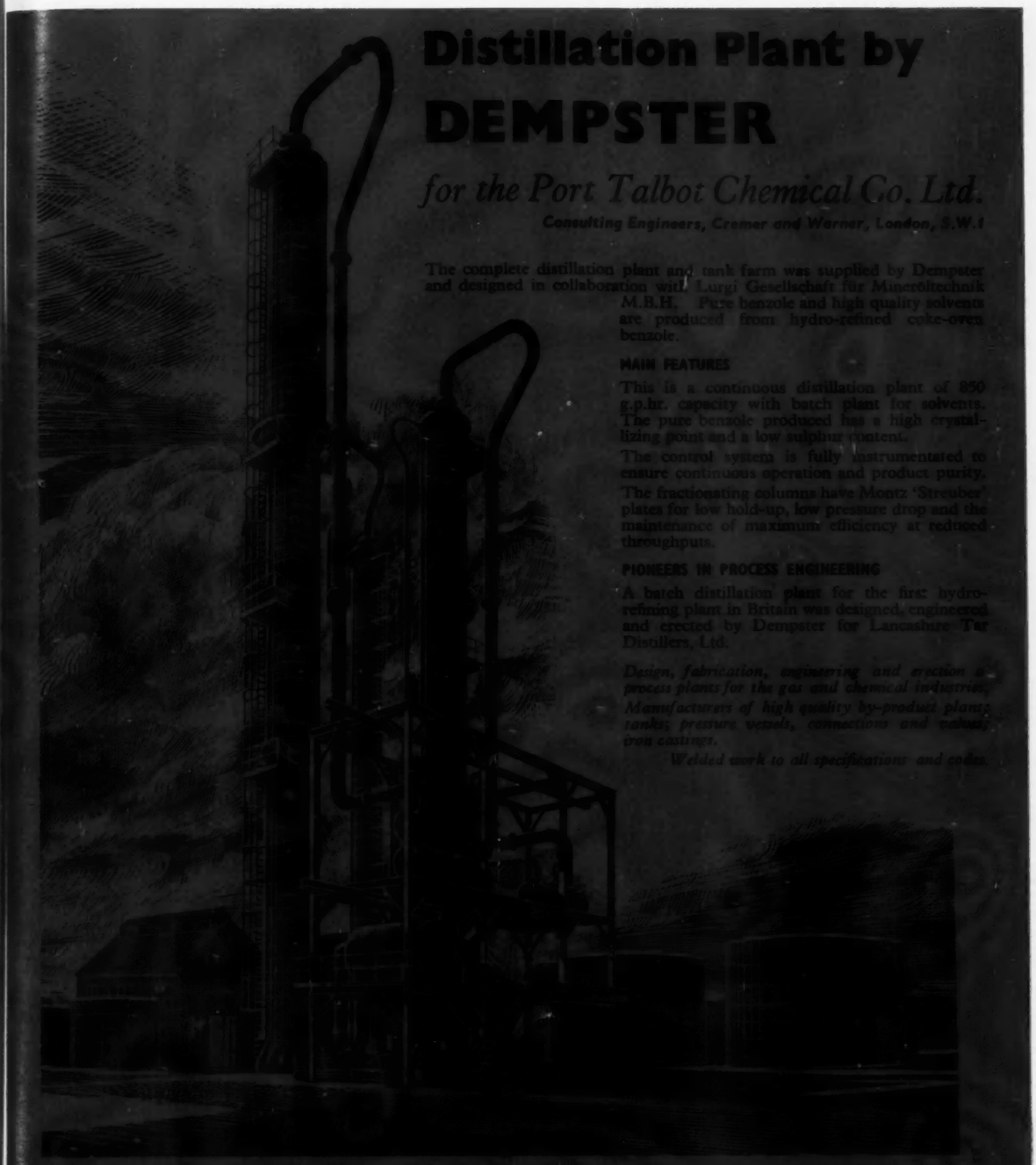
THE UNIVERSITY OF MICHIGAN
APR 20 1960
ENGINEERING LIBRARY

Gas Journal

VOL. 302 | 112th YEAR | LONDON, APRIL 6, 1960 | No. 5040 | PRICE 1/6



Distillation Plant by DEMPSTER

for the Port Talbot Chemical Co. Ltd.

Consulting Engineers, Cremer and Werner, London, S.W.1

The complete distillation plant and tank farm was supplied by Dempster and designed in collaboration with Lurgi Gesellschaft für Mineralöltechnik M.B.H. Pure benzole and high quality solvents are produced from hydro-refined coke-oven benzole.

MAIN FEATURES

This is a continuous distillation plant of 850 g.p.hr. capacity with batch plant for solvents. The pure benzole produced has a high crystallizing point and a low sulphur content.

The control system is fully instrumentated to ensure continuous operation and product purity.

The fractionating columns have Montz 'Streuber' plates for low hold-up, low pressure drop and the maintenance of maximum efficiency at reduced throughputs.

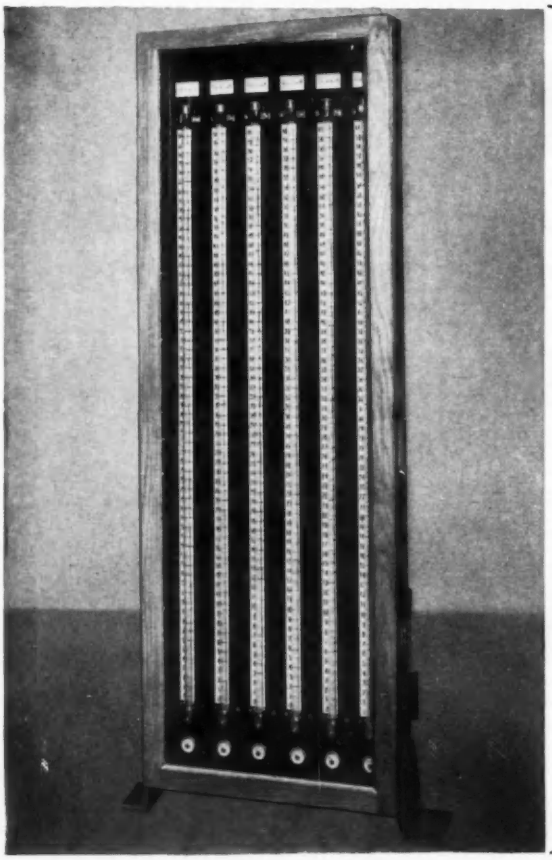
PIONEERS IN PROCESS ENGINEERING

A batch distillation plant for the first hydro-refining plant in Britain was designed, engineered and erected by Dempster for Lancashire Tar Distillers, Ltd.

Design, fabrication, engineering and erection of process plants for the gas and chemical industries. Manufacturers of high quality by-product plant; tanks; pressure vessels, connections and valves; iron castings.

Welded work to all specifications and codes.

R. & J. DEMPSTER, LIMITED *Constructional, Gas and Chemical Engineers*
NEWTON HEATH · MANCHESTER 10 *London Office: 33 Victoria Street, S.W.1*



PRESSURE GAUGES

FOR

THE GAS AND CHEMICAL INDUSTRIES

Milne (Edinburgh) Ltd.

MILTON HOUSE WORKS
MILTON STREET
EDINBURGH · 8

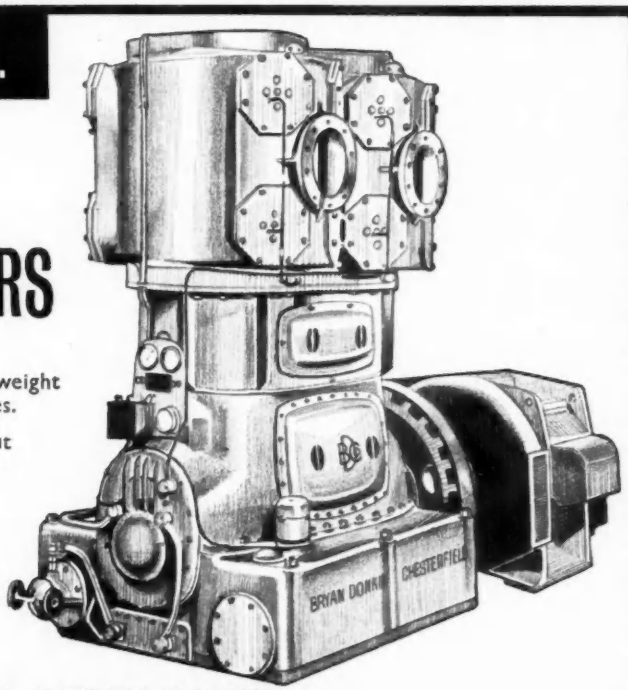
LEEDS BRANCH · MIDLAND METER WORKS · VICTORIA ROAD

DONKIN TYPE 300/A.

VERTICAL RECIPROCATING COMPRESSORS

FOR GAS OR AIR

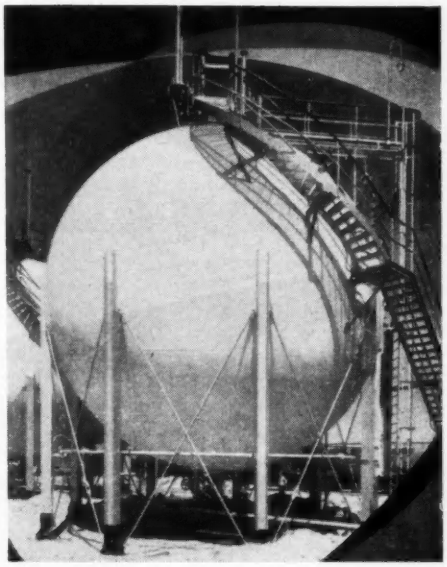
- Drop forged connecting rods, give improved weight strength ratio and reduction in unbalanced forces.
- Precision manufactured shell bearings throughout ensuring fuel inter-changeability without fitting.
- Light alloy frame doors of generous dimension give easy access to interior.
- Built in centrifugal oil filter and cooler.
- Compressors can be supplied in weatherproof construction for outdoor installation, with canopy protection only.



SINGLE STAGE TWO STAGE THREE STAGE

THE BRYAN DONKIN COMPANY LIMITED TELEPHONE 3153 (6 lines)
CHESTERFIELD • LONDON AND TORONTO

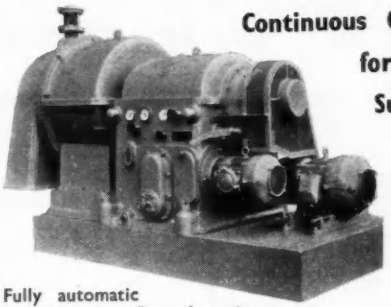
M·A·N



Spherical vessels for storage of gases and liquids under pressure.

Pressure tanks and containers of every description for the gas, oil and chemical industries.

M. A. N. plant and equipment are being manufactured in the United Kingdom, to the design and specifications of M. A. N.



Continuous Centrifuges for Sulphate of Ammonia

Fully automatic and continuous Centrifuges for all solids/liquids separation problems of the gas, oil and chemical industries.

also Vacuum and Pressure Filters and Driers

KRAUSS MAFFEI IMPERIAL GmbH
MUNICH

Both M.A.N. and K.M.I. are represented by :

W. WYKEHAM & CO., LTD
17-19 COCKSPUR STREET · LONDON · S.W.1
Cable address: "WYCOTRAF" Telephone: WHitehall 5307
TELEX : 22448

Research Laboratories :
AEON Laboratories, Ridgemead Road, Englefield Green, Surrey

Gas Journal

VOLUME 301 • NUMBER 5040 • 112TH YEAR

WEDNESDAY, APRIL 6, 1960

CONTENTS

EDITORIAL COMMENT

Should Advertising be Everybody's Business? - - 17
Successful Enrichment by p.f.d. - - - - 18
Nalgo's New Home - - - - - - - 19
Valves and Industry - - - - - - - 19

NEWS SUPPLEMENT

Canada Breaks into U.S. Gas Market - - - 31
Hours-slash for 70,000 Gasmen - - - - 31
New Holder Erected - - - - - - 31
Shop While You Lunch Scheme - - - - 31
Russian Gas and Oil Strikes - - - - - 31
Personal Notes - - - - - - - 32
North Western Board Smash Cooker Records - - 32
Calendar and Directory Alterations - - - 32
Forthcoming Events - - - - - - 32
Gas Central Heating Experiment - - - - 32
TECHNICAL DEVELOPMENTS - - - 28

TECHNICAL RECORD

The Effect of Light Distillates on Carburetted Water Gas Production. By J. V. Craddock and R. W. Hind - - - - - - - - - - 20

GAS IN INDUSTRY SUPPLEMENT

Editorial Comment: G.A.W.I.I. Goes North - - 101
Gas Behind the TV Screen - - - - - - 102
Overhead Heating Installation Covers 11 Acres - 107
Control Under Variable Pressure Conditions with YK Regulator - - - - - - - - 107
Harrogate Gas at Work in Industry Exhibition. By Eric Ford - - - - - - - - 108
Board's Plastic Welding Torch Reduced Costs - 116

Editor :
GEOFFREY W. BATTISON

Assistant Editor:
COLIN J. GODBOLD

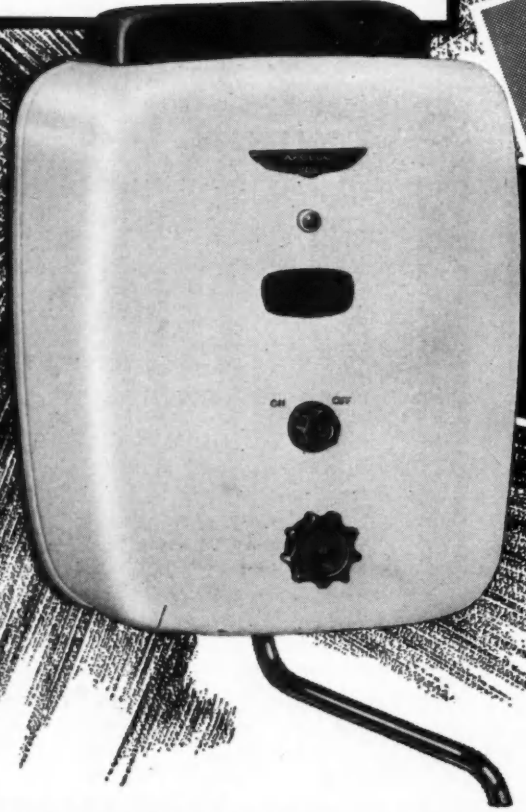
Technical Editor:
CHARLES J. P. DE WINTON,
T.D., M.A., M.Inst.Gas E., M.Inst.F.

PUBLISHERS' NOTICE, SEE PAGE 33

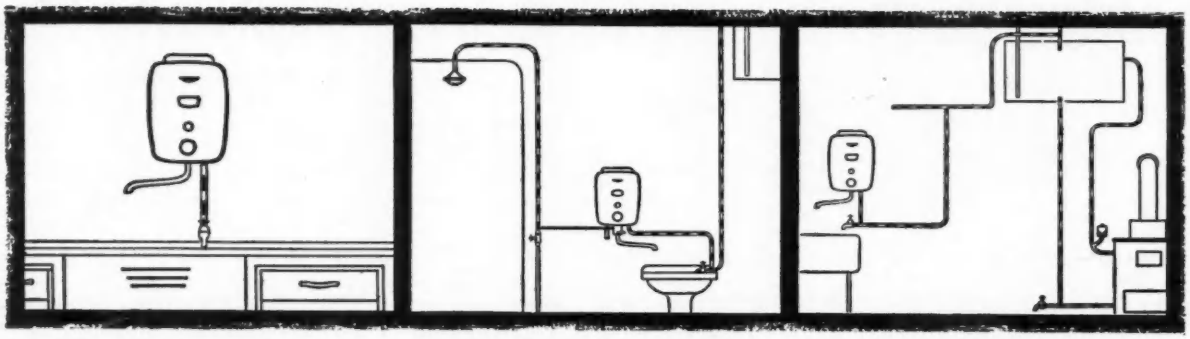
The FIRST...

..REVOLUTIONARY

..THERMOSTATICALLY CONTROLLED



instantaneous
WATER HEATER
THE MAIN
APOLLO



For single point use...

At the sink or washbasin, connected to main or tank supply, the Apollo provides instantaneous hot water, at 0.5 gallons a minute, at a constant 140°F, irrespective of fluctuations in the water input temperature.

shower purposes...

With its constant temperature output the Apollo provides an efficient inexpensive shower supply. Dilution by cold water feed gives selected water output temperatures.

or as a booster....

Connected to the draw-off pipe of an existing hot water system the Apollo will boost the system's output at that point to a temperature of 140°F. For the utmost economy, it makes the most of any storage system.

Instant hot water at a Thermostatically Controlled temperature!

MAIN WATER HEATERS LIMITED · GOTHIC WORKS · CROYDON · SURREY

Note the name-made by MAIN

W150

Gas Journal

COKE OVENS • BY-PRODUCTS • CHEMICALS

Should advertising be everybody's business?

WHAT a glorious subject for argument is furnished by advertising! One can discuss the merits and demerits of particular advertisements until the cows come home and seldom, if ever, can one prove anything at all. Nowhere is there a greater gulf between the expert and the layman, and nowhere does the latter have a better opportunity of expressing an opinion on what he only imperfectly understands. If one sought the views of employees in the gas industry on Gas Council and area board advertising, would anyone seriously expect a higher acceptance of its excellence, or even adequacy, than perhaps 25%? This is not a reflection of the poor quality of the advertising, because much the same response might be expected from employees in any other industry. The fact is that everyone thinks he knows better than the advertising specialist, whose work—'if you can call it work'—is regarded with the deepest suspicion.

Nothing inflames the professional advertising man more than the sweeping criticisms and pinprick irritations of the man who 'knows what he likes.' The publicity manager has only to get on his feet (or even show his face) at a technical or sales meeting for someone to lead the hounds in roundly condemning everything he and half the best agency brains in the country have been sweating on for months past. Even when the publicity man is as resilient as Mr. Reg Gregg, the dice are always loaded in favour of the critics. Nobody can prove *them* wrong!

On the whole we tend to side with the experts, not because we set ourselves up as authorities on the subject, but because advertising is a tough profession and the men who succeed in it are specialists. With advertising men one has to take a certain amount on trust; what is the use of employing specialists if one is not prepared to accept their opinion? At the same time advertising must never be allowed to develop into the holy cow of industry. The practitioners of advertising are responsible for very substantial sums of money (which they inevitably regard as inadequate) and there is never any harm in reminding them every now and again that the fortunes of a great many people depend on their efforts.

A few weeks ago we published an article by a gas board accountant who put forward some unusual, even eccentric, ideas on how the gas message might be brought to the attention of various sections of society. The author, Mr. E. Teskey-King, is another layman critic, but we thought his suggestions refreshing enough to deserve publication. Judging by our correspondence they have met with a mixed reception.

Only one journal—the North Western Gas Board's *Link-up*—has ventured to comment on the article. While admitting that the 'professionals would be witless indeed if they failed to take notice of this accountant's criticism,' the writer goes on to warn against the 'countless medley of printed documents in which it is possible at excessive cost to hide our messages and fritter our funds away.' Instead, taking his cue from the oil companies' bold broadsides, he pleads for a 'policy of concentration and boldness as against diffusion and timidity.' Fair enough. Let us by all means concentrate our advertising on full-page layouts—the point is, how are we going to use the space when we've bought it? In other words, does gas advertising as we know it exhibit those qualities of strength and attractiveness likely to make the best use of the expensive, concentrated approach?

There are certainly some who have their doubts. The April issue of *Gas Service* will contain a short article by yet another lay critic, Mr. W. M. Bothwell, who takes a somewhat jaundiced view of most gas advertising, be it of Gas Council, area board or appliance maker origin. He complains of lack of appeal, impact and imagination; he finds gas appliance advertising discreet, insipid and impersonal. He compares it unfavourably with oil, which is perhaps not surprising, but also with C.U.C. advertising for which he clearly has a considerable regard. Unlike Mr. Teskey-King, however, he does not offer any very clear suggestions, except perhaps that there might be more stress laid on the tangible benefits of gas, and that gas itself (the word) should be featured

more strongly. We shall publish the article not because we regard Mr. Bothwell as contributing anything very constructive, but because his views seem to us to be more or less typical of those held by many people in the industry.

There is one point which might usefully be discussed: Is Mr. Therm in danger of losing his appeal as an advertising symbol? It has been suggested to us recently that his long reign may be coming to an end. No clear reason was given save that he was beginning to look a little old-fashioned. For our part we do not subscribe to his view. In our opinion Mr. Therm remains the finest advertising symbol of all time, but even he can look old-fashioned in an old-fashioned setting. Every day we pass a gas refrigeration poster with a strong 1935 flavour; in this Mr. Therm looks distinctly dated.

Perhaps the best tribute to his effectiveness is the electricity industry's continuing efforts to find a rival. 'Live Wire,' who writes an electrical column in the *Domestic Equipment Trader*, observed last month: 'I have been noticing for some time now that in the advertising of the electricity boards and the British Electrical Development Association (EDA) a small boy wrapped in a towel and obviously fresh from his bath has been appearing with some regularity. He certainly looks a cute little fellow and I can only presume that somewhere in the back of someone's mind must be the idea that, given the right sort of treatment, he can become the answer to Mr. Therm of the gas industry. If that is so, then I think he must become just a bit more mobile than he has to date. . . . If he is to be the indicator of things electrical, he must be given a name. What about "Master Lee"—the growing symbol of the electrical way of life?' To which we would reply: 'Splendid! Go ahead—it's a rotten name.'

Finally, before we leave this vexed subject, we wonder what will be the reaction to the Gas Council's new series of layouts, each related broadly to an industrial or professional group of interests and bearing the general title 'It's his future. . . .' Nobody is likely to complain of lack of boldness about *these*, but will the drawings be regarded as sufficiently sympathetic?

Successful enrichment by p.f.d.

ANY means by which the capacity of existing gas-making plants may be increased without major structural alterations are always of importance as well as being of considerable interest. If at the same time the costs of gas manufacture are reduced, such means are of great value to the industry.

Such an achievement is possible by the substitution of gas oil by primary flash distillate in carburetted water gas plants and in a paper to the Midlands Junior Gas Association which we are publishing this week, J. V. Craddock and R. W. Hind, of the Chesterton gasworks in the Midlands, explain in some detail how they have been able to exploit the use of p.f.d. as a means of improving the performance of an existing water gas plant.

The availability of p.f.d. in large quantities is of interest in itself and shows how the balance of sales of petroleum products can be disturbed by the introduction of a different type of internal combustion engine by the motor transport industry on the one hand and the development of gas turbines and jet engines on the other. The increased use of gas oil for diesel engines by lorries and even London taxi cabs has created a big demand for this particular oil product, which was until recently the accepted means of enriching blue water gas. Gas turbines and jet engines use the less costly kerosene fraction, and so also do farm tractors, with the result that considerable quantities of 'No. 3 petrol,' as p.f.d. might be more familiarly known, have become available.

Since the petrol fraction represents about 40% of the primary distillation products of crude oil, it is not surprising that the increasing demands for other distillation products should have caused such a plentiful supply of p.f.d.

Experiments to find a substitute for gas oil for enriching blue water gas have been going on for a number of years and the first attempts were made with heavy oils. Their use meant modifying existing carburettors to improve vaporisation before cracking, and also the steam heating of storage tanks and possibly steam-tracing exposed oil conduits to prevent blockages in cold weather. There were, too, other difficulties connected with the formation of emulsions and undesirable charactistics of the tar made. Heavy oil was in fact an unsatisfactory substance for this particular purpose and one which would never have been normally considered.

It was of particular interest to us therefore when, about three years ago, we heard that the South Eastern Gas Board had successfully carried out experiments in the use of light petroleum distillates to replace the conventional gas oil for enrichment. Their use had already been envisaged by the same Board for gasifying in its Segas plant at the Isle of Grain, where it has now been successfully used.

Clearly such a substance had properties eminently suitable for use in water gas plants; it is easily volatilised, of high enough calorific value, unlikely to form any quantity of tar, and easily cracked into products of high volatility and suitable calorific value with the production of manageable amounts of free carbon.

It was also clear, however, that considerable care must first be taken to provide the most stringent safety precautions when handling this highly inflammable low boiling liquid. These precautions are now so highly organised that the most dangerous part of the operation undertaken is unloading the p.f.d. from the tanker wagons into storage tanks.

We understand that the South Eastern Board have now adapted at least four of their water gas plants for use with distillate and that the Eastern Board too is using it with success. The present paper, however, is not only our first intimation that a plant had been adapted in the Midlands, but it is also the first full

description we have read of a plant under full working conditions.

There were several points in the paper which we found particularly noteworthy. For example, it appears that increased outputs might be as high as 25% to 30% above normal. Thus the advantages to be gained from a combination of reforming the oil in the generator furnace and the enrichment of the blue water gas by conventional carburetting must be regarded as being of great value. From the figures given, the cost of gas production by combined reforming and enriching was noticeably less than by plain enrichment by gas oil. Since conditions in the generator are quite different on the back-run during reforming, the accepted calculations for blue water gas outputs and conditions for its formation have to be modified; so too has the cycle of operations to allow a second 'oiling' phase. Temperatures of the producer bed are clearly of first importance to ensure that the maximum production of blue water gas and the maximum degree of reforming are achieved. Other precautions which must be taken include the extraction of naphthalene from the gas, in which there may be up to 70 grains per 100 cu.ft. This has been successfully done in a naphthalene washer. The absence of tar from the products had the effect of causing condenser and wash box valves to become dry with consequent difficulties in operation, but if spent oil from the naphthalene washer is sprayed for a short period during each up-run, sufficient tar is formed to overcome this drawback. The hydrogen sulphide of the gas made is reasonably low at 120 to 160 grains per 100 cu.ft.

Here then is a process which is economic, of high efficiency and is making use of a raw material which is readily available. The resultant gas is easily purified to town gas standards and the objectionable by-products of the process seem few and appear to be easily dealt with.

In the discussion which followed the paper, one speaker was most enthusiastic about the possibilities offered by such a process for reducing costs of peak load gas to a level almost equal to the cheapest base load coal gas. This in turn would make a great contribution to the supply of cheap gas to industry, a most important consideration, especially in the Midlands.

Has the gas industry any serious competitors for the use of this particular distillation product? We do not know, but it does appear to us that it offers to those works too far away from oil refineries to benefit from piped refinery gas, a real opportunity of taking full advantage of a very useful oil product, which the oil industry might have considerable difficulty in disposing of; unlike refinery gas, it cannot be flared to waste. Liquefied petroleum gases find a ready market in their own right, many of them being complementary to the supply of town gas, but this particular fraction of crude petrol, containing about 96% paraffins of the C_7-C_8 range, does seem to be a boon to the gas engineer.

Commentary on the News

Nalgo's new home

'NALGO is now Britain's biggest trade union for "blackcoated" workers in the English speaking world,' said Mr. N. W. Bingham, this year's Nalgo President, when he inaugurated the new headquarters in Harewood Row, Marylebone, London, last Friday. 'It is the seventh biggest union of any kind in Britain and we know of only one "blackcoated" union in the world which is bigger—Nalgo's opposite number in Western Germany.'

All of which prompts us to look into the history of this 55 year-old trade union. Founded in 1905 with a membership of 8,000 and an annual nett subscription income of £32, Nalgo has grown steadily and continuously until today it has a membership of 263,000, an annual net subscription income of £380,000 and reserves of £762,000. Growth has brought with it a need for increased office accommodation and this has been reflected in the five headquarters occupied since 1905. Starting with a letter box in a solicitors office in Ludgate Circus from which the first general secretary, Mr. L. Hill, collected correspondence on his way to work to be dealt with in his lodgings at night, it has moved successively to 26, Bloomsbury Square, where it shared one floor of a private house with the Library Association, to Caxton Hall, to 24, Abingdon Street, to 12, Nash Houses in Regents Park, and finally to the present site. This is the first headquarters to be specially adapted for the needs of the Association and the first modern building it has occupied. Laid out on four floors with a strongroom in the basement, it has 36,000 sq. ft. of office space with ample accommodation for the Association's activities. A dining room and recreation room provide amenities for a full time staff of 80.

Nalgo being what it is, an association of people who are to some extent State employed, it is perhaps a little ironical to find them sheltering under a dyed-in-the-wool private enterprise roof. For their landlords are Woolworths! Perhaps that is why there is a dislike of the word 'landlord!' They prefer 'lessor'—a Nalgoish word indeed!

Valves and industry

THE colour film 'Valves at the heart of industry,' shown recently to the Press by the Audley Engineering Co. Ltd., emphasises the incredible extent to which valves control the life flow of civilisation as we know it. There were many interesting applications shown, such as that at a cider factory in Herefordshire where the valuable product was being loaded into road tankers, but it was the more familiar locations which held us. For example, the manufacture of coke at the Avenue plant near Chesterfield, shots of the Wales Gas Board's Aberavon gasworks and an N.C.B. benzole refining plant—all these contributed to show how wide are the applications for a reliable valve in the fuel industries.

Interesting shots in the film of the factory at Newport, Salop, showed to what fine limits the valves are made. Shots of cut-away models demonstrated how the lubricant is forced into the passages and grooves machined in the valve body and the closely-fitting taper plug. Any stiffness in operating is dispelled by forcing lubricant into the space beneath the plug and, lifting it clear, easing it from the valve body. The plug cock of antiquity—at least 2,000 years old—has by proper lubrication become the reliable and precise instrument we saw applied to so many industries in this, one of the best industrial films to come our way.

GAS JOURNAL April 6, 1960

From a paper to the Midland Junior Gas Association.

The effect of light distillates on carburetted water gas production

By J. V. CRADDOCK, Assoc.M.Inst.Gas E.,

and

R. W. HIND, Assoc.M.Inst.Gas E.

A LIGHT petroleum distillate has become available as a result of the changing pattern of demand for the products of the oil refineries now established in this country. In the refining of crude oil, the proportion of the petrol fraction produced in relation to other fractions, such as kerosene, gas oil and heavy oil, is about 40%. The present-day requirements of industry, however, show an increasing demand for the heavier fuel oils, diesel oils for commercial vehicles and kerosene for tractor and jet fuels.

There is therefore a surplus of the petrol fraction, from which the light hydrocarbon feedstock is taken. It is known by a variety of names; primary flash distillate or p.f.d. is the name used by our Board. Our suppliers, Shell Refining Co. Ltd., Stanlow, refer to it as L.D.F. 170. It contains 96½% of paraffin hydrocarbons.

The p.f.d. may be used for enriching blue water gas by cracking in the carburettor in the normal manner. It can, in addition, be reformed by passing the vapour through the fuel bed during the normal back-run of the cycle. When reforming, the thermal yields from the raw materials cannot be calculated by the accepted water gas formulæ.

Complex reaction series

Reforming in its broadest sense is the conversion of a mixture of gaseous hydrocarbons of high calorific value, high specific gravity and low combustion velocity into a larger volume of gas mixture of lower calorific value, lower specific gravity and higher combustion velocity. It can be applied to the vapour of a hydrocarbon oil or to a hydrocarbon gas by passage through a fuel bed or a catalyst bed. In this country, reforming has hitherto been accomplished by simple thermal cracking at high temperatures. In America, some of the hydrocarbons have also been made to react with steam.

The complete series of reactions occuring during reforming are extremely complex. They consist of a sequence of both decomposition and polymerisation reactions. The feedstock is also a complex mixture of hydrocarbons, and therefore any equations used should be regarded only as showing the mass overall result from an average condition, and do not necessarily represent any separate stage in the process taking place.[1]

In this paper we are only concerned with two of the several methods by which reforming can be accomplished. These are:—

1. Exposing the hydrocarbon alone to the action of heat, generally referred to as thermal cracking.
2. Exposing the hydrocarbon to the action of heat in the presence of steam as a reactant, generally referred to as steam reforming.

When a paraffin is decomposed by heat, the primary reactions will involve either (a) breaking the hydrogen to carbon bonds or (b) severing the carbon to carbon bonds. For paraffin hydrocarbons of higher molecular weight than propane and at elevated temperatures, only the second class of reaction is of importance. The result is a paraffin of lower molecular weight than the original reactant and an unsaturated hydrocarbon of the olefin series. The paraffin will readily react with steam, and the olefins may also be reacted with steam or further decomposed by the direct action of heat. The products from these reactions may include the deposition of carbon and the formation of hydrocarbons of ringed structure, such as benzene and naphthalene.

The objects of using steam in the reforming of hydrocarbons to form fuel gases are (a) to increase the volume and total heat content of the gases produced from a given amount of feed hydrocarbons, and (b) to modify the composition and thereby the specific gravity, calorific value and burning characteristics of the product gas.

The mechanism of the reactions of steam with a hydrocarbon has not been well established, even for the lower paraffin hydrocarbons. Morgan[1] suggests that formaldehyde may be important as an intermediate compound in the reaction between propane and steam.

$$C_3H_8 + 3H_2O = 3HCOH + 4H_2$$

The formaldehyde decomposes on heating to give carbon monoxide and more hydrogen. Although the mechanism may be complex, the overall reaction is simple:—

$$C_3H_8 + 3H_2O = 3CO + 7H_2 - 214{,}141 \text{ B.t.u.} \quad (1)$$

By this reaction, 1 cu.ft. of propane with a gross calorific value of 2,465 B.t.u. per cu.ft. yields 10 cu.ft. of carbon monoxide and hydrogen, with a total heating value of 3,194 B.t.u. per cu.ft. Thus the heating value of the products is 729 B.t.u. per cu.ft., greater than that of the propane used.

Ideal reforming condition

This thermal and volumetric change can be of great advantage in the manufacture of gas, and represents the ideal condition in reforming. It can be noted that the reaction is highly endothermic and is, therefore, likely to take place only at fairly high temperatures.

Experiences at Chester, Pa.,[2] and the work at Southampton[3] suggest that under less suitable fire conditions, the steam reforming reaction will not proceed to completion. In this event, the overall reaction may be represented by:—

$$C_3H_8 + H_2O = CH_4 + CO + 3H_2 + C - 57{,}280 \text{ B.t.u.} \quad (2)$$

This reaction is less endothermic and will, therefore, proceed preferentially, so that 1 cu.ft. of propane with a

calorific value of 2,465 B.t.u. per cu.ft. will yield 5 cu.ft. of gaseous products with a calorific value of 2,273 B.t.u. per cu.ft. Although there is a volumetric gain here, there is at the same time a thermal loss of 192 B.t.u. per cu.ft. The deposition of carbon during the reaction contributes to this loss. This reaction is also of advantage in the manufacture of gas, since it does, in part, fulfil the object of reforming.

The water gas plant at the Chesterton works of the West Midlands Board is a Humphreys & Glasgow fully automatic, mechanically operated set, rated at 1¾ mill. cu.ft. per day when making carburetted water gas at 470 B.t.u. per cu.ft.

The additional p.f.d. equipment was installed by Humphreys & Glasgow Ltd. in August, 1958, and consists of a storage tank, centrifugal pump and supply line to the plant. A series of hand, magnetic and mechanical valves are provided to give complete control of the flow and provide a high standard of safety.

The minimum number of flanged joints have been used, the pipe joints have been butt welded and the whole of the equipment from the outlet of the pump to the carburretor spray has been tested to 200 p.s.i. In addition, all flanges, cocks, valves and covers on the feedstock line from the spray have been bonded with copper tape to the storage tank, and earthed. All the electrical equipment is of flameproof construction, bonded and earthed.

An emergency isolating valve of the magnetic solenoid type is situated on a balcony outside the plant. Inside, the supply passes through a Solway Flowrator indicator, and then divides into two lines, each of which has a cast steel Audco Hyperseal control valve. Between the lines is an inverted Fisher valve, operated by the back-run lever. The lines come together again and the supply passes through a magnetic interrupter valve, another Fisher valve, operated by the oil lever, and on to the spray in the carburetter. Since the spray is not removed from the carburetter during heat raising, a continuous steam purge is fitted to keep the spray cool.

During the up-run, the interrupter valve and the oil Fisher valve are open. This allows the p.f.d. to flow from the Flowrator to the spray. The rate of flow is regulated by an Audco valve. A cam operated switch on the 'auto' closes the interrupter valve five seconds before the end of the up-run. The operation of the back-run lever opens the inverted Fisher valve, and the opening of the interrupter valve five seconds later, allows the flow to continue to the spray. The additional supply is regulated by a second valve 'b' to give the required back-run rate. At the end of the back-run both Fisher valves close to shut off the supply.

The p.f.d. is delivered in 4,000-gal. road tankers and off loaded by gravity through 2 to 2½-in. hoses, and takes about 25 minutes. The storage tanks are pressurised with foul gas from the outlet of the condenser and fitted with flame traps and pressure relief valves.

Since p.f.d. is highly inflammable, it must be handled with great care. Off-loading is probably the time of greatest risk and portable foam fire extinguishing apparatus is kept in readiness close to the storage area. In addition, a fire alarm switch is provided for the off-loading attendant to summon assistance. Dry powder fire extinguishers are kept on the ground floor and operating platform of the plant.[4]

The details of the cycles used when, enriching only and enriching and reforming are shown in Fig. 1.

When p.f.d. was used for enriching only the normal 'gas oil' settings and steam rates were used, the secondary air was admitted later to give lower carburettor and superheater temperatures. The plant was operated at various carburettor temperatures to determine the best conditions for the minimum naphthalene and carbon formation. The quantity of naphthalene produced varied from 15 to 20 grains per 100 cu.ft. at the inlet washbox and caused no trouble at the condenser. Tar production was virtually nil, consequently the washbox and condenser valves soon became dry and were stiff to operate. Since there was no means of disposing of the wash oil from the naphthalene

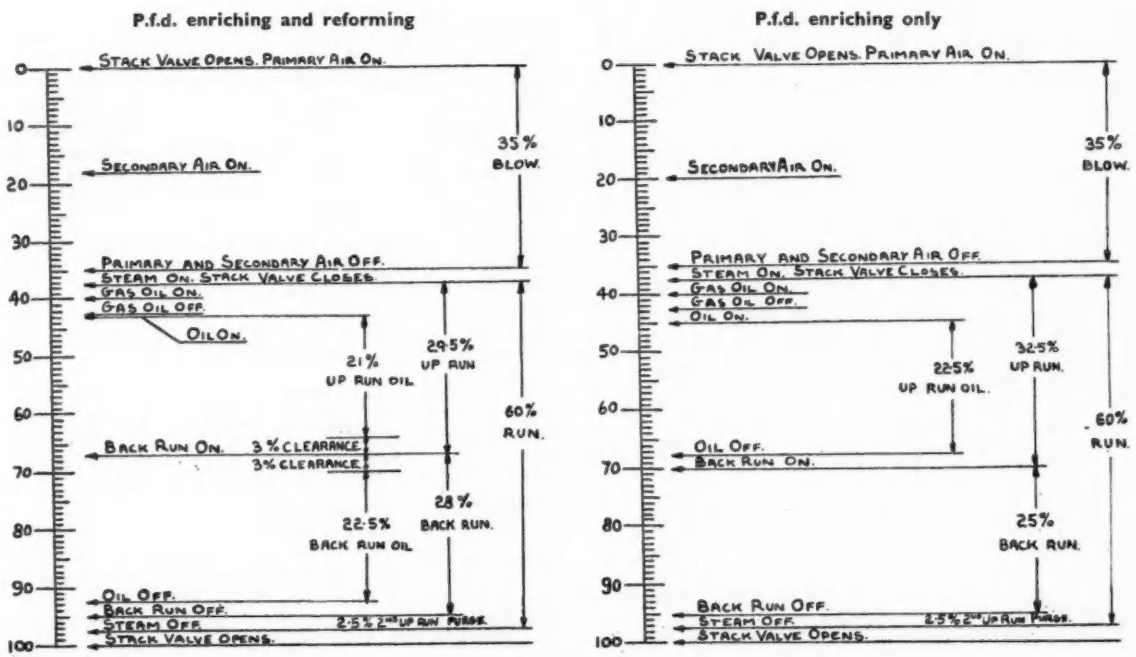


Fig. 1. Sub-divisions of a two-minute, 40-second cycle.

washer, permission was given by the Excise Officer to inject naphthalised gas oil through the p.f.d. spray during the up-run. A connection was made close up to the spray and a cam operated switch on the 'auto' opened a magnetic valve to inject ¼ gal. of naphthalised gas oil every up-run.

The tar so produced improved the operation of the valves and any carried forward along the inlet holder main had a real effect when pumping syphons. The naphthalene figure at the inlet washbox, however, increased to 25 to 30 grains per 100 cu.ft. A pet cock was put in the up-run main and regular tests carried out for carbon formation. The jet of gas was allowed to impinge on a filter paper and a trace made over the whole of the up-run period. Carbon was found at all temperatures from 1,300°F. to 1,440°F. There was a marked increase at temperatures over 1,400°F., so the final carburetter temperature adopted was 1,380°F. The carbon formed contributed to the build-up in the condenser when reforming, causing an eventual back-pressure.

When p.f.d. was used for enriching and a proportion reformed at the same time, the up-run period was reduced slightly, to give additional time for reforming on the back-run. The up-run steam pressure was increased from 28 p.s.i. to 46 p.s.i.

The back-run steam rate was reduced from 42 p.s.i. to 26 p.s.i., and the reforming oil rate increased to the limit imposed by the plant pressures. Tests for free carbon were made regularly and the amount of steam kept as low as possible with the minimum formation of free carbon in the gas. The final instantaneous steam : oil ratio used was .9 and test with filter papers on the back-run main showed only a light brown stain and a slight trace of carbon.

Lighting blow gases

At low carburettor temperatures (1,280°F. to 1,300°F.), and a maximum reforming rate, lighting of the blow gases was often difficult, because of the chilling effect of the oil on the top of the fuel bed. It was necessary to work the fuel bed level 6 in. to 9 in. lower than normal and maintain a temperature of 1,000°F. to 1,050°F. at the top of the generator, to give satisfactory lighting conditions. When the carburettor temperature was raised to 1,380°F. the blow gases could be lit satisfactorily with the fuel bed at normal level.

The naphthalene produced when reforming amounted to 60 to 70 grains per 100 cu.ft. A higher trace of tar was also produced in the back-run as indicated by the stain on the test papers.

Screened large coke was used as generator fuel and its consumption was approximately 23 lb. per 1,000 cu.ft. of final gas made.

The carbon deposited in the fire caused no difficulty with the operation of the grate. At a grate extraction rate of 15 to 20% the annulus, temperatures were 'lively.' The clinker and ash extracted was softer and smaller than when enriching only, it was also much darker in colour, suggesting a coating of carbon.

Due to the increased weight of steam and feedstock passing through the fire, the back-run temperature was increased when reforming. At low fuel bed levels, the temperature indicated by the back-run pyrometer, was 720°F., some 170°F. higher than normal. At the normal level, the temperature was reduced to 640°F. The same general settings were used for reforming only. The main oil cam on the 'auto' cam shaft was adjusted to open the oil valve for the required period on the back-run only.

Naphthalene began to appear as the tar in the system disappeared. At a condenser outlet temperature of 120°F., and before the installation of a naphthalene washe the naphthalene was carried forward to the oxide purifie and deposited on the top of the oxide in the first an second takers. As the plant was only working one shi each day, the boxes were not rotated for six weeks an tests showed no naphthalene at the outlet of the purifier

A naphthalene washer was installed at the inlet to th purifiers and gas oil was recirculated at a rate of 30 ga per mill. cu.ft. gas made. This reduced the naphthalene a the inlet of the purifiers to 1 to 1.5 grains per 100 cu.ft.

With the possibility of naphthalene build-up in the underground inlet holder main, the condenser outlet tem perature was reduced to 80°F. The naphthalene deposited caused partial blockage in the condenser with the conse quent back pressure on the set. Water gas tar was sprayed into the inlet condenser main in an attempt to clear the blockage. It was not successful and the practice was discontinued. The condenser was cleared once a week by raising the outlet gas temperature to 150°F. and spraying in 5 gal. of paraffin. A considerable quantity of naphthalene came out in the condenser seal pot, and was immediately removed. The remainder was removed with the condensate at the syphons on the inlet holder main. Recently the condenser was thoroughly steamed out and some 4 cwt. of naphthalene with some carbon were removed. Now that naphthalised gas oil is being injected regularly, there are indications that the naphthalene is being removed at the condenser seal pot and syphons.

After nine months operation the plant was shut down for the annual inspection. The plant vessels were found to be in good condition, carbon penetration of the brickwork was in evidence, but no more than when using gas oil. The back-run valve casing and disc were well coated with soft carbon; about 5 lb. was removed and the valve faces were found to be in excellent condition. There was some carbon in the flared tee from the back-run main to the washbox. The washbox contained a normal quantity of deposit, but of a rubbery consistency containing little tar.

The inlet relief holder main was drilled at two points and a 2 to 3 in. deposit was found consisting of naphthalene with some tar; it was very soft and contained considerable moisture. The detarrer was free from naphthalene, but the electrodes were coated with a greasy deposit which was partly removed when the vessel was steamed out. It was necessary to remove the remainder by washing the interior of the vessel with a light oil. The naphthalised gas oil may be used for this purpose when the plant is shut down for inspection. No difficulties have been encountered in the operation of the exhauster and meter, and the purifiers were free of naphthalene.

The plant is operated for a single shift each day and operating results are based on observations taken during a normal day's working.

Fire conditions

Under these circumstances, a variety of fire conditions can be encountered. For the purpose of comparing results under different methods of operation, the plant was considered to be working under the same fire conditions when the steam used, the air used and the analysis of the b.w.g. were approximately the same.

Under a comparable condition of operation, the use of reforming results in an increase in the output of the plant of 22% by volume. Under other conditions of operation, increases of up to 30% over results obtained with gas oil were possible. Such an increase in output makes necessary an increase in the oil consumed from 1.5 to 2.6 gal. per 1,000 cu.ft. of gas made.

It was found that the amount of oil gas made from the

team reforming reaction is not independent of the blue gas. For example, one test showed the maximum of reformed gas and the minimum of blue gas, whereas in another the position was reversed. This can to some extent be explained by both reactions occurring in the same vessel and being sustained by the same source of heat.

When reforming is taking place, there is a reduction in the make of b.w.g., since to whatever extent the heat stored in the fuel bed is supporting the steam reforming reaction, it will similarly restrict the b.w.g. reaction. Reforming appears to take place readily and to a large extent replaces b.w.g. formation during the time when the oil is injected. This may be observed from back-run samples taken only over the oiling period, which show over 70% of reformed gas. The use of reforming will therefore cause a reduction and variation in the yield of b.w.g.

Average equation

When enriching only, the thermal yield is higher than when reforming. The lower thermal yield when reforming will be due to the carbon deposited as shown in the average equation for reforming.

$$C_{3\cdot55}\ H_{9\cdot1} + H_2O = CH_4 + Co + 3.55\ H_2 + 1.55C - 59{,}813\ \text{B.t.u.}$$

Most of this carbon deposition will occur in the generator and, therefore, it cannot be entirely regarded as a loss to the process. When reforming only, not all the therms obtained from the oil are the result of the steam reforming reaction. The olefins formed from the primary thermal cracking of the oil, also make a contribution.

When reforming, the carbon gasified as b.w.g. is reduced by about 4.8 lb. per 1,000 cu.ft. of gas made. If the carbon deposited by the steam reforming reaction is converted to b.w.g. then the carbon required from coke for b.w.g. formation will be further reduced to about 7.1 lb. per 1,000 cu.ft. of gas. This amount of carbon corresponds to 8.1 lb. of coke per 1,000. Results in practice showed that when reforming, the coke consumption was, in fact, reduced by approximately this amount.

The reduction of 4.8 lb. in the carbon made into b.w.g. per 1,000 cu.ft. represents a reduction of .4 therms of b.w.g. per gal. of oil used for reforming.

Heat is required from the fire to provide for the gas-making reactions that are taking place in the generator. Observations show that .203 therms are absorbed from the fire per therm of b.w.g. made and .063 therms per therm of reformed gas. Each lb. of steam converted into b.w.g. will require .022 therms from the fire and each gal. of oil supplied for reforming will absorb .043 therms from the fire. The introduction of reforming in the proportions used, makes little difference to the heat demand from the generator per cycle. The heat that has to be returned to the generator by the burning of carbon during the blow is, therefore, of a similar order in each method of operation.

In the normal operation of a water gas plant, *i.e.*, for enriching only, the coke supplied to the generator is mainly consumed for two purposes:

1. It is burnt during the blow to store heat in the fuel bed for the b.w.g. reactions.
2. Carbon is gasified during the run by the b.w.g. reactions.

When reforming, a change occurs and some part of the coke consumed during the blow must be regarded as supplying heat for the reforming reaction. From this there is no corresponding production of b.w.g. There is, therefore, a reduction in the b.w.g. therms obtained per 1,000 lb. coke consumed in the generator when reforming takes place. Operating results show that there is a reduction of 8.8 lb. of coke consumed and that the b.w.g. yield is reduced by 2.5 therms during reforming. This implies a lower efficiency of b.w.g. manufacture when reforming, but in reality, this is not so, since the coke is supplying the heat to sustain the reforming reaction.

It has been noted that the amounts of b.w.g. and reformed gas made, appeared to be dependent on each other, but a detailed study of the temperature record of the plant to determine under what conditions the best yield of reformed gas was obtained, showed no firm conclusion in this matter.

Two sources of variation in the rate of reforming appear to be possible.

1. All the oil is not cracked.
2. After cracking, the available hydrocarbons do not react with steam. In this case, the loss does not appear as a thermal loss, but only in the reduction of the volume of gas made. This is important, since much of the advantage in cost of reforming is dependent on obtaining the volume.

Time seemed to be a factor in the steam reforming reaction. On occasions when the carburetter and fire top were cooler, good reforming was still obtained if the lower parts of the fire were hot. This condition, however, restricted the opportunity for b.w.g. formation.

When enriching only, the effect of the carburetter temperature could be more clearly seen. At temperatures of 1,400°F. there was some visible evidence that carbon was beginning to be carried over in the gas stream and therefore a temperature of 1,380°F. seemed to be the most suitable operating temperature.

Very little tar is formed in the process, consequently the concentrations of free carbon and naphthalene are high, but the small quantity there is, minimises the difficulties of handling. After 500,000 gal. of p.f.d. had been gasified a 10-ton load of tar was obtained for sale, representing .4% of the oil used.

Naphthalene in gas stream

Considerable quantities of naphthalene have appeared in the gas stream. Before the gas leaves the works the naphthalene is reduced to a safe level by gas oil washing in a Clapham washer. Nevertheless, between the condenser and the naphthalene washer, some 42 lb. of naphthalene per mill. cu.ft. of gas made—30 lb. per day—are deposited in the works' mains and plant. In addition, there are deposits in the condenser. The means adopted to deal with this, have already been described. In 14 months of operation, there has been no occasion when the plant has been prevented from working by reason of naphthalene deposits, but this experience is, of course, based on a plant that only works one shift per day.

Less naphthalene is formed from enriching than from reforming. The passage of the olefin hydrocarbons that cannot react with steam, through the relatively high temperature of the fire, is the most likely explanation of the naphthalene production. About 1% of the carbon of the oil is lost as naphthalene.

The total steam produced per cycle by the annulus and waste heat boilers was 165 lb. to which the waste heat boiler contributed 94 lb. Under ideal conditions, allowing for steam pumps and losses, but not blow down, this was just sufficient to keep the plant self-supporting in steam. In all the reforming tests, the percentage of steam converted, was greater than when enriching only.

The b.w.g. reactions are still the largest contributor to the final gas mixture. With the inert gases accompanying them, the calorific value of this portion of the output is about 280 B.t.u. per cu.ft. The calorific value of the

gases from the steam reforming reaction is 441 B.t.u. per cu.ft., but some contribution to the calorific value is made by the olefins that necessarily accompany the reforming reaction. The result is that each gal. of oil, per 1,000 cu.ft. of gas made, used for reforming will raise the calorific value of the gas by 50 B.t.u. When enriching, each gal. of oil per 1,000 used for enriching, raises the calorific value by 100 B.t.u.

The specific gravity of the gas made ranged from .53 to .570 according to the amount of reforming that has taken place. When enriching only, the specific gravity was .66.

The plant operated with an instantaneous steam : oil ratio of .9 and an overall steam : oil ratio on the back-run of 1.13. This represents a rate of .84 lb. of carbon per lb. of steam during the period of oil injection. In the reforming of refinery gas, rates of .55 lb. of carbon per lb. of steam, have been used and this rate was tried on our plant. No difference, however, in the thermal yield from reforming was noted.

Samples of p.f.d. gas taken from the outlet of the purifier were subjected to refrigeration with solid CO_2, and showed an average paraffin content in the condensate of 60.8%, together with 11.1% olefins and 27.1% of aromatics. The high proportion of paraffins present is interesting, since they amount to 12% of the paraffins supplied in the p.f.d. oil. The aromatics amount to .14 gal. per 1,000 cu.ft. of gas.

The hydrogen sulphide content of the gas was 120 grains per 100 cu.ft. when enriching and reforming and 160 grains when enriching only. The corresponding figures for total organic sulphur were 9 grains and 15 grains respectively.

TABLE 1

Gas	C.V.	Sp. Gr.	Wobbe	Group No.	A.T.B.	Aeration No.
Coke oven gas ..	474	·440	720	4	35	64
Enriching and reforming with P.F.D. ..	470	·560	630	6	25	49
C.W.G. (with gas oil) ..	470	·660	530	7	22	43
Mixture : 50% P.F.D. gas +50% CO gas	472	·492	673	5	29.2	55
25% C.W.G. + 75% CO gas ..	473	·495	673	5	31·7	59

Table 1 shows the combustion properties of the gas streams that are mixed at Chesterton gasworks. It would appear that when reforming is applied in the water gas process, twice the quantity can be mixed with the base load coke oven gas without serious alteration in the combustion characteristics.

Manufacturing costs have been based on the results obtained with the conditions of working at Chesterton, when making gas at 468 B.t.u. per cu.ft. Raw material costs to the plant are: P.f.d. at a calorific value of 1.39 therms per gal., 8.45d. per gal.; gas oil at a calorific value of 1.67 therms per gal., 13.625d. per gal.; coke cost to c.w.g. plant, including handling, 133s. per ton, and a selling price for tar at 8d. per gal.

The prime cost of c.w.g. enriched by gas oil is about 11½d. per therm, enriched by p.f.d. it is 9.83d. per therm and when a combination of enrichment and reforming is employed, it falls to 9.62d. per therm. There appears to be little difference in the cost of raw materials per therm of gas made when enriching only or enriching and reforming. There are, however, certain advantages to be gained from both methods of operation.

When enriching only with p.f.d. existing coke stocks can be reduced and a cheaper water gas therm is the result of the lower oil price. When enriching and reforming the output may be increased by 20 to 30%, and the additional oil used at a lower thermal yield per gal. is balanced by the reduction in coke consumption. The lower specific gravity enables the increased output to be fully exploited at times of peak load.

REFERENCES

[1] J. J. Morgan 'Gasification of Hydrocarbons,' Moore Publishing Co., New York, 1953.

[2] John W. Carrol, 'Reforming of Refinery Oil Gas, Liquefied Petroleum Gas and Gas Oil', A.G.A. Proceedings, 1948.

[3] W. F. Thorne, R. K. Harrison, and J. R. Fairman 'Experiences with Refinery Gas at Southampton', I.G.E. Comm. No. 536.

[4] Notes on the Use of p.f.d. in Gasworks, West Midlands Gas Board.

[5] 37th Report of the Joint Research Committee, I.G.E. Trans, **85**, 1935-1936.

[6] E. R. Ward, 'The Use of Light Petroleum Distillate', I.G.E. Comm. No. 515.

[7] 'Test Code for Carburetted Water Gas Plant', B.S. 1784: 1951.

DISCUSSION

Mr. S. Brockbank, Newcastle-under-Lyme, opening the discussion, said that the authors were members of his own staff, and he had suggested to them that they should record their experiences of the use of p.f.d. in the form of a paper and present it to the Association for the benefit of members. It described work done over a period of 12 months and though the calculations referred to had not been fully considered, they should prove of value to members. There had been no stoppage in gas making as a result of using p.f.d., but it should be remembered that the water gas plant at Chesterton had been used for only one shift per day. The only difficulties experienced were those caused by a slight blockage in the p.f.d. filters.

Mr. J. Foxton, Cheltenham, said that there was still a good deal to be learned about the use of p.f.d. It had now been used in a number of different types of plant and troubles with naphthalene formation varied accordingly. He agreed that the gas industry had to find fuels other than coal for gasmaking and the resultant gas had a higher hydrocarbon content than was normal with coal gas. The new type of gases made were compressed and there was the problem of what to do with the deposited liquid hydrocarbons. He doubted whether the outlet of the purifiers was the best place to take freezing tests, and suggested that such tests should be done at the inlet before there could be any deposition in the purifiers. He asked whether the tar deposited in mains was in fact tar or nitrogenous gum, since the latter seemed more likely in this type of plant.

Mr. Craddock replied that they were using 8% of gas oil with the up-run p.f.d. and the amount of tar produced was normal for this quantity of gas oil; there appeared to be no gum formation.

Mr. Hind added that, of course, there was much less tar formed when no gas oil was added.

Mr. P. Ashen, Wolverhampton, said that in a cyclic process, the rate of gas production was variable, and asked whether any attempt had been made to obtain a true sample of the gas as it was made, and what type of test for naphthalene was used and he wanted details of the method of gas analysis. He wondered whether gas oil was used to

remove naphthalene and since the plant described in the paper was working for only one shift per day, whether any estimate had been made of the troubles likely to be encountered with naphthalene if the plant was working continuously.

Mr. Hind replied that only one plant was at work for one shift each day. All the gas passed through a large relief holder which was emptied each day. Samples were taken at the outlet of this holder by a constant rate apparatus over the period of the day's operation.

The test used for naphthalene was the conventional method based on the formation of naphthalene picrate with recent refinements to correct for indene. (L. A. Raval *Chem. and Ind*: 1947 p. 758. Mott and Moulson, *J. App. Chem.* 1957, part 10 p. 548.)

The results were related to the saturation values for naphthalene in the gas stream. The gas analysis was by absorption methods, employing vessels of the Orsat type, and controlled combustion over a copper oxide—iron oxide catalyst. This method had been developed by Gaz du France and check tests with the Gooderham constant volume apparatus showed the results to be accurate.

Mr. Craddock said that the gas oil was used primarily to dispose of the spent oil from the naphthalene washer. The tar produced helped to remove some of this naphthalene. Unsuccessful attempts had been made to clear the naphthalene from the condenser by spraying with c.w.g. tar and they would like to have tried vertical retort tar for this purpose, but it had not been possible to dispose of the effluent. This type of condenser was not the most suitable and if continuous reforming were practiced, a contact washer of the Lymn type would be essential.

Mr. S. K. Hawthorn, Birmingham, said that the water gas plant at Chesterton was the first to use p.f.d. in the Midlands. The authors had, therefore, taken advantage of the opportunity to submit their paper for the benefit of members of the Association. By using p.f.d., gas could be made at approximately 1¾d. per therm cheaper than with gas oil, and yet the authors in their paper had not claimed any credit for this very substantial reduction in manufacturing costs. In the Birmingham Division, when all plants were using p.f.d., the saving could well be of the order of £1,000 per day. The cost of gas made with p.f.d. would then be approximately the same as that made from coal and would relieve the coke position.

Naphthalene formation from p.f.d. was less than from gas oil, but there was no tar formed to dissolve the naphthalene as was the case when gas oil was used. Mr. Hawthorn asked for the authors' views on what should be the minimum temperature in the carburettor. Referring to the steam generated in the waste heat boiler, he said that the production of steam was lower than normal in order to keep the temperature in the carburettor down. There must be some escape of combustible gases and therefore some devices would be necessary to restore the normal steam production in the manufacture of c.w.g.

Mr. Craddock replied that various tests had been made to determine the most suitable carburettor temperature for efficiency and its effect on carbon formation, which varied little between 1,300°F and 1,420°F. They were both concerned about naphthalene formation during reforming and he suggested that a more complete reaction between the steam and hydrocarbons would help to minimise the trouble. Belgian gas engineers had recently reported that precracking of the hydrocarbon vapours by their passage first through the superheater and carburettor, gave more complete reforming. Time and temperature were most important in this precracking. (H. W. J. Kempen *Revue Général du Gaz*, Jan.—Feb. 1959).

Mr. Hind added that the lower the carburettor temperature was kept during enriching, the less was the thermal yield. Refrigeration tests described in the paper had shown that when the carburettor temperature was about 1,280°F, there had been an escape of uncracked hydrocarbons. The chemical reactions during reforming were very complicated and would require further study.

Mr. F. H. Bate, Wolverhampton, also referred to the prospects of gas production with p.f.d. at a lower cost than with gas oil and said that in his division—Wolverhampton—one large firm had already turned to gas as a fuel and a very substantial load had therefore been won. Another large firm was making similar plans. Referring to the naphthalene washer being installed at the inlet of the purifiers he pointed out that at Dudley the mains were only 18-in. in diameter and therefore likely to become blocked very easily. Here at any rate the proper place for a naphthalene washer seemed to be at the inlet to the holder. The quantity of condensate from the refrigeration tests with solid CO_2 should not, he thought, be as high as 4.5 gal. per 10,000 cu.ft. of gas. He was interested in Mr. Foxton's remarks about the resultant deposits from compresing the gas and asked whether there was not therefore some risk attached to the process.

Mr. Hind replied that the refrigeration tests were done with solid CO_2 at a temperature of $-70°C$. The amount of condensate was greatly reduced at 36°F.

Mr. Craddock agreed that the naphthalene washer should be installed as close to the plant as possible. At Chesterton the naphthalene washer had been installed at the inlet purifiers, since suitable connections were available at this point and their main concern initially had been to keep the town gas free of naphthalene.

Mr. W. R. Saunders, Wolverhampton Engineering Society, asked on what basis the costs of manufacturing gas with p.f.d. and with gas oil had been calculated and whether the naphthalene was separated, so that it could be used by the Midland Tar Distillers Ltd.

Mr. Craddock said that the cost of using gas oil had been compared with the current cost of p.f.d. The naphthalene was not recovered for sale.

Mr. C. Halstead, Birmingham, asked what was the average CO_2 content, when enriching, of the generator blow gases at a superheater base temperature of 1,330°F., and also, whether there was any change in the formation of naphthalene when the oiling period was increased or reduced. It was not sufficient to indicate the temperature only since the period of oiling was also important.

Mr. Craddock replied that the average CO_2 content of the generator gases was approximately 16%. During the up-run the naphthalene was not produced in any large quantity and the period of oil injection had not varied, but he agreed that such a variation might well cause an increase or decrease in the amount of naphthalene produced. It was difficult to carry out the naphthalene test on the hot gas and so it was not easy to relate the naphthalene content to the rate of oil supply.

Mr. Hind added that when enriching only, the up-run oil rate was approximately 5 gal. per cycle, and when enriching and reforming, the up-run rate was 2.5 gal. per cycle. The cracking efficiency was better at the slower

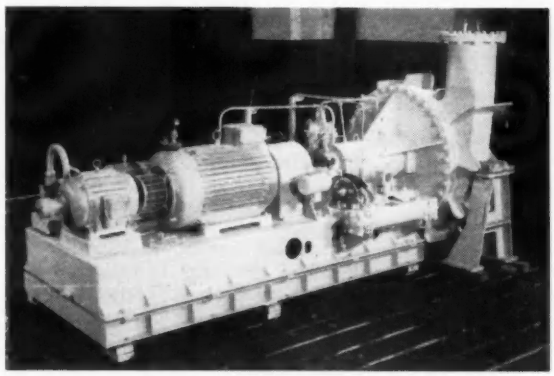
(Continued on p. 30)

Technical developments

Sealed gas blowers

THE Sirocco sealed gas blower has been specially developed for applications where dependable leak tightness is essential, because of corrosiveness, toxicity, radioactivity, or commercial value of the gas being handled. Designs have also been developed to cover severe conditions of temperature and pressure.

Impellers may be of axial or radial flow type. Casings for high circuit pressures will normally take the form of enveloping cylindrical pressure vessels; for lower pressures a normal volute, suitably stiffened if required, can be utilised in the form of either a casting or fabrication. Bearings of either plain journal or ball and roller type support the impeller shaft; in high circuit pressure applications, a special thrust bearing is incorporated to carry the heavy axial load. Where high temperatures apply, shafts may be of hollow construction cooled by a suitable fluid, and shaft seals of various types from simple labyrinth



The Sirocco sealed gas blower.

up to mechanical oil face and gas operated hydrostatic types, can be fitted according to the degree of sealing required.

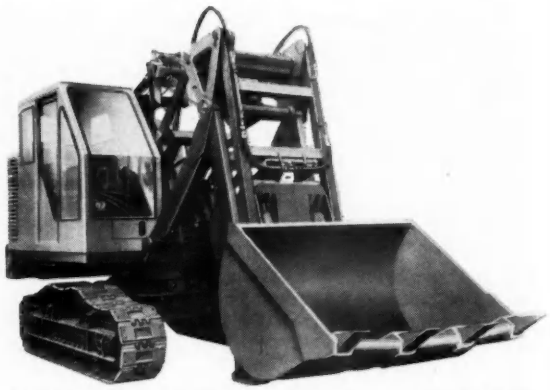
In the gas industry, inflammability demands a high standard of gas tightness. A number of gas boosters have been manufactured where the circuit medium was producer- or coal-gas at moderate pressures and temperatures. —*Davidson & Co. Ltd.*

Hydrascoop shovel

A NEW hydraulically-operated mechanical shovel specially designed for excavating and loading in quarries and sand and gravel pits, will handle up to 350 cu. yards per hour using less than 70 h.p. To be known as the Hydrascoop, it has been designed for hard, continuous work and has been subjected to proving trials over several months working in granite, limestone, sandstone and heavily compacted soil.

On rehandling work the Hydrascoop will speed up the loading of materials such as coal, coke, and chemicals. For this work the 2-cu. yard bucket is standard, but for lighter materials, i.e, coal and coke, larger buckets can be fitted.

Raising and lowering of parallel linkage is by hoisting line-clutch and brake drums are booster-operated and controlled through foot pedals giving effortles operation. Bucket thrust and break-out operations are hydraulically



The hydraulically-operated Hydrascoop mechanical shovel which can be used for handling coal, coke and chemicals.

operated through finger-light controls and a digging force of 26.5 tons is exerted at the bucket teeth. The Hydrascoop has a 360° swing with 20 ft. level clean-up radius. It will dig any angle of slope and excavate to 2 ft. below ground level. A maximum discharge height of 9 ft. 10 in. assures ample clearance to load the largest capacity dumpers and wagons.

The hydraulic system is fully sealed and constant power to the rams is delivered by the hydraulic pump which is driven by front engine power take-off from the base machine's 6-cylinder diesel engine which develops 67 b.h.p. at 1,380 r.p.m.

Simple controls provide a ready facility for rapid change-over from travel to operation. It is transported by low loader without dismantling as the overall width of the unit is well within the limits permitted by road regulations.—*Blaw Knox Ltd.*

Compressed air tool

A NEW precision-built compressed air tool, the Powerpac, can be used for a variety of sanding, wire-brushing and soft-buffing jobs. Complete with the necessary tools and accessories, the outfit is packed in a handy carry-all metal box.

The B.E.N. Powerpac compressed air tool.

The high-performance air motor, with its large reserve of power, can operate the heavy duty sanding disc, and can quickly smooth off after repairs to metal work with a minimum of effort. The sander may also be used effectively in all types of woodworking operations. The lambswool mop, which is easily fitted over the sanding pad, gives a quick final polish to all jobs, while the cleaning of rusted surfaces in preparation for painting, welding etc., is effectively done by the cup or wheel type wire brushes. In addition, the chuck attachment enables a wide variety of additional workshop tools to be used, including drills up to $\frac{5}{16}$ in. diameter.

The Powerpac runs at a speed of 1,500 r.p.m. under a working pressure of 80 p.s.i. and with an air consumption of 11 cu.ft. per minute.—*B.E.N. Patents Ltd.*

Trade publications

AN informative and well-illustrated publication describing the Velovent system of air conditioning has been received from Air Control Installations Ltd. This system, which was developed by a Swedish firm and first used there in 1953, provides for heating, cooling, humidifying, or de-humidifying, by means of compact units which are supplied with pre-treated air and hot or chilled water from a central plant.

The exact amount of air required for ventilation is supplied through a small size duct; small bore pipes convey hot or chilled water to the heater/cooler battery in each Velovent unit, to maintain the desired room conditions. The pre-treated air passing through the unit induces room air to flow through the heater/cooler battery, thus maintaining an adequate circulation of air at the desired temperature in the office.

The Velovent unit is made in a range of standard sizes and is normally installed beneath a window with the discharge grille located in a shelf which may run the length of the room. The front is enclosed by panelling, which conceals all pipes and ducts and also hides electric and telephone cables.—*Air Control Installations, Ltd.*

* * *

Since 1913 William Press & Son Ltd. have carried out major contracts throughout the United Kingdom in the fields of civil engineering, pipe-line construction, industrial pipe-work, pipe-work fabrication and plant erection. Now a book has been published designed to give a pictorial survey of the company and its associates' achievements. It is a handsomely produced volume, lavishly illustrated with colour and black-and-white photographs. Particularly striking are the shots of the laying of the Shell Haven to Romford pipe-line, and the twin self-supporting water and gas pipe-line under Donnington Bridge, crossing the River Thames.—*William Press & Son Ltd.*

* * *

A comprehensive manual entitled *B.K.L. Tubend Welding Fittings,* which comprises a specification of all their elbows, return bends, equal tees, reducing tees, concentric and eccentric reducers and caps, has just been produced by B.K.L. Alloys Ltd. A particularly important feature is the collection of tables which give comparisons between British and American Standards. Also, there is a section with information on materials suitable for low-temperature service. The catalogue is in loose-leaf form and protected by an attractive, stiff plastic cover.—*B.K.L. Alloys Ltd.*

* * *

Phosphoric acid plants for the production of phosphatic fertilisers are the subject of a new brochure recently prepared by Chemico. The digestion and filtration systems are clearly explained by excellent drawings, and the special features of the Chemico phosphoric acid process are listed, together with other phosphate processes available from this company.—*Chemical Construction (G.B.) Ltd.*

* * *

A new brochure by the International Furnace Equipment Co. Ltd. entitled *Modern Gas Producer Plant,* describes the many types of plant manufactured by this company and gives details of industrial applications.—*The International Furnace Equipment Co. Ltd.*

GAS JOURNAL

Readers' Enquiry Service

Details and coupons are given on the backing page

Light distillates and water gas—discussion—from p. 27

rate, but there was no noticeable difference in the amount of naphthalene formed.

Mr. McIntyre, Wolverhampton, asked whether the magnetic type valves had given any trouble. His own experience had been that this type of valve was not sufficiently reliable and he preferred motorised valves.

Mr. Craddock said that the only trouble the magnetic valves had given had been a slight leakage at the terminal box on one of the valves.

Mr. S. A. Tait, Redditch, referred to the deposits of carbon on the grate rings. He said that at Redditch the c.w.g. plant operated 24 hours a day, and when using p.f.d. the carbon was deposited when reforming. He went on to describe the method employed to remove the carbon from the grate rings. He also pointed out that with a superheater temperature of 1,420°F. there had been no excessive formation of naphthalene, and that the plant was working at an efficiency of 75%.

Mr. Craddock replied that they had had no carbon deposit on the grate rings, but were getting a fall-off in production caused by a decrease in the air rate. This had recently been traced to a build-up of carbon in the blast main from the outlet of the blast valve to the point where it joined the back-run main. The higher specific gravity of the feedstock used at Redditch would require the higher cracking temperature.

The President, **Mr. S. C. Porter,** referred to the steam equation [p. 14] which deduced the average value of 'n' as 3.55 and said that this figure could be checked by determining 'n' in the p.f.d., allowing 96% saturation, by ultimate analysis.

Mr. Hind said that the value of 'n' for the p.f.d. feedstock calculated from the ultimate analysis would have a value of about 7. When the feedstock was sprayed into the carburettor, primary thermal cracking took place; this had been represented in the paper as $C_7 H_{16} = C_3 H_8 + C_4 H_8$ (olefin). As a result, the steam reforming reaction took place with paraffins of lower average molecular weight. The presence of olefins in the final gas supported this mechanism.

Mr. C. P. Astbury, Birmingham, pointed out that there was no reference in the paper to steam purging of the p.f.d lines, when the plant was shut down.

Mr. Craddock replied that the plant was shut down each day, and it had been found that steaming out the p.f.d. lines had an adverse effect on the Flowrator and joints. Steam purging was therefore only done when repairs were being undertaken, or for long shutdowns.

Mr. D. Ferguson, Birmingham, pointed out that according to the paper 42 lb. of naphthalene per mill. cu.ft. were deposited between the condenser and the naphthalene washer, this was equivalent to 30 grains per 100 cu.ft.; he asked how much naphthalene was deposited in the wash-box.

Mr. Hind agreed that this amount was equivalent to 30 grains per 100 cu.ft., but added that very little naphthalene was deposited in the wash-box.

Mr. Foxton, Cheltenham, referring to the purging of the p.f.d. lines, agreed that steam purging destroyed the joints, but a new type of jointing was now being used at Gloucester which withstood steam purging.

Readers' Enquiry Service

If you would like more information on products and services mentioned in the advertisement or editorial pages of the 'Gas Journal', fill in the coupons below, *one for each enquiry,* and send in unsealed envelope to **'Readers Enquiry Service', Gas Journal, 11 Bolt Court, Fleet Street, London, E.C.4.**

Please send further details about.....

.....

..... mentioned on page .....

of the 'Gas Journal' for .....

Name .....

Firm .....

Address .....

.....

..... BLOCK LETTERS PLEASE

Please send further details about.....

.....

..... mentioned on page .....

of the 'Gas Journal' for .....

Name .....

Firm .....

Address .....

.....

..... BLOCK LETTERS PLEASE

Canada breaks into U.S. gas market

GOVERNMENT'S GO-AHEAD FOR $1,850-MILL., 25-YEAR PLAN

NEWS SUPPLEMENT

FOUR companies have been granted permission to export gas from Western Canada to the United States. A fifth company—the Niagara Gas Company, a subsidiary of Consumers' Gas—has been refused because the price it quoted was too low.

The four gas-exporters will be Trans Canada Pipe Lines, Alberta & Southern Gas Company, Westcoast Transmission Company, and Canada-Montana Pipe Line Company. Between them they hope to transmit 6,529,000 mill. cu.ft. of gas in the next 25 years.

Total reserves

It has been estimated that Canada's total proven gas reserves at the end of 1959 were 30,300,000 mill. cu.ft. and that surplus supplies by 1989 will total 46,400,000 mill. cu.ft., compared with the present figure of 9,300,000 mill.

The Canadian Petroleum Association has estimated that new exports will provide nearly $500 mill. to gas producers in the period 1961-68 and that the total new revenue to the industry over the 25-year period will be $1,850 mill.

Mr. Frank McMahon, the President of Westcoast Transmission, said after the announcement that the decision would mean the construction of an additional 300 miles of 30-in. pipe-line into the new discovery areas around Fort Nelson, in British Columbia, along with extensive gathering systems extending into the North West Territories.

Maximum rate

According to the terms of the Government's approval Trans Canada is authorised to export up to a maximum daily rate of 204 mill. cu.ft. to the U.S. Midwestern Gas Transmission Company. Exports over 20 years would total 1,410,000 mill. cu.ft.

Meanwhile, Alberta & Southern is planning a huge pipe-line complex to transmit the gas 1,400 miles to the San Francisco area and will export at a daily rate of 458.75 mill. cu.ft. from Kingsgate, in B.C. Over a period of 25 years the export total is expected to be 3,826,000 mill. cu.ft. The company gives the cost of the project as $337.8 mill.

Westcoast

Westcoast Transmission is authorised to transmit 152 mill. cu.ft. daily with a total over a 20-year export period not to exceed 1,020,000 mill. cu.ft.

Canada-Montana plans to use Alberta & Southern pipe-line facilities to export to Montana up to 36 mill. cu.ft. daily over 25 years.

Hours-slash for 70,000 gasmen

THE National Joint Industrial Council for the Gas Industry has concluded an agreement for the reduction of the working week for about 70,000 day-workers from 44 to 42 hours, without loss of pay, as from May 1, 1960. The trade unions have agreed to co-operate in the maintenance of production and the achievement of greater efficiency.

A similar working week for 16,000 shiftworkers employed in the industry had already been agreed earlier in the year and will be introduced at the same date.

NEW HOLDER ERECTED

A new 4 mill. cu.ft. gasholder has just been completed for the Southern Gas Board at Garsington Road, Cowley, Oxford. It is expected to be put into commission in May or June, when it will be filled from the Reading and Southampton works. The holder will serve Oxford, Aylesbury, Banbury, Bletchley, Buckingham, Leighton Buzzard, and other towns and villages in the northern part of the Board's area.

Shop while you lunch scheme sells appliances

THOUSANDS of Leicester workers may be able to do their lunch-time shopping in canteens if an experiment is followed up.

A decision by a number of firms to halve the lunch break to three-quarters of an hour comes into force on April 11. Workers will finish work for the day three-quarters of an hour earlier—at 5.30 p.m.—when most city centre shops close.

Anticipating the detrimental effect on shopping, the East Midlands Gas Board approached N. Corah (St. Margaret) Ltd., one of the city's largest employers, for permission to utilise their canteens as showrooms. The results, in a fortnight's experiment which ended on March 25, were remarkable—18 refrigerators being among the items sold.

The novelty, and the elimination of outside distractions, are believed to help sales efforts.

Mr. J. R. Burdett, Catering Manager of Corah's, told the 'GAS JOURNAL' that his work had not been hindered.

Russian gas and oil strikes soaring

THE prospected oil resources of the U.S.S.R. have increased 'more than fourfold' in the past ten years, according to Professor Foma Trebin, Chairman of the state technical and scientific committee. The cast scope of geological surveying had helped in discovering new, immensely-rich gas- and oil-bearing grounds and in ensuring the rapid growth of the Soviet oil and gas industry. He said that the estimated gas resources of the U.S.S.R. are of the order of 55-60 mill. cu.m.

The advanced level of drilling techniques in the U.S.S.R. facilitated the rapid development of new deposits. The drilling of oil wells at depths of up to 5,000 m. had been completely mastered, and equipment for drilling 7,000-10,000 m. wells was being designed or was in the early stages of manufacture.

Professor Trebin claimed that in 1954-58 the U.S. drilled over 150,000 wells, while her oil production rose by less than 12½ mill. tons. During that period the U.S.S.R. drilled one-eighth as many wells, but increased oil output by 60½ mill. tons. Mechanisation and remote control of oil production eventually would cut down the labour force to one-fifth or one-sixth of what it is today.

Professor Trebin cited figures showing that the gap in oil production between the U.S.S.R. and the U.S.A., which used to be very wide, has been considerably narrowed in recent years. In 1946, the U.S. had an 11 to 1 advantage over the U.S.S.R. in this respect. By 1955, the U.S.A. oil production was five times as great as in the U.S.S.R., and the corresponding figure for last year was only 2.7.

In 1960, 144 mill. tons of oil and over 53,000 mill. cu.m. of gas were to be produced, he said.

PERSONAL NOTES

MR. G. LE B. DIAMOND, C.B.E., has been re-appointed Chairman of the West Midlands Gas Board. The Minister has also re-appointed ALDERMAN C. G. SPRAGG, O.B.E., of Smethwick, and PROFESSOR F. H. GARNER, O.B.E., of Birmingham, part-time Members of the Board. MR. A. E. HEWITT, C.B.E., M.C., who has been a member of the Board since it was formed in 1949, will retire from the Board on completion of his present term of office.

MR. ROY WALKER has joined Kelvin & Hughes (Industrial) Ltd. as a specialist representative for North Wales, South, East and West Ridings of Yorkshire and the northern parts of Lincolnshire and Derbyshire. Mr. Walker augments a field force of specialist representatives available for consultation and demonstration of non-destructive testing equipment, electronic instruments and high speed recording equipment.

MR. E. H. BADCOCK, Manager, Supply Section, Coke Department, is to be seconded to the Coal Department of the North Thames Gas Board as from April 18. MR. F. E. LONGHURST, at present Manager, Sales Section, Coke Department, will be Sales Manager, Coke Department, from the same date.

MISS ELSIE GREIG has been appointed Advertising and Publicity Officer to the Scottish Gas Board, as successor to MR. JOHN R. CLARK who held the post for four years.

Manx government rejects plea for freight rebate

SHAREHOLDERS of the Port Erin and Port St. Mary Gas Company, Isle of Man, were told by the Chairman, Mr. W. C. Kelly, at the annual meeting, that an application from smaller gas companies in the Island for a freight rebate for coal used in gas production, similar to that for domestic coal, has been rejected by the Manx Government.

The accounts submitted by Mr. Kelly showed total assets of £45,556. Receipts were £18,935. Manufacture and distribution of gas cost £15,702, management and other expenses £2,199, and transfer to renewals account £316, leaving a profit of £717.

Balance from the previous year was £1,413. The dividend of 4%, approved by the meeting, absorbed £506, and £1,624 was carried to the next account.

W. H. SISMEY MOVE

W. H. Sismey & Co. Ltd., carbonising engineers and contractors, have closed their Halifax office and the business has been transferred to 241, Alcester Road South, Birmingham 14. Telephone: Highbury 1369.

NORTH WESTERN BOARD SMASH GAS COOKER SALES RECORDS

DURING a special sales drive in the last nine weeks the North Western Gas Board sold 40,799 gas cookers, worth more than £1¼ mill., to householders in Lancashire and Cheshire.

This achievement is believed by the Board to be a record for all boards.

The number sold in the nine-week period is nearly half the entire number sold in the last working year and is 26% better than sales in the same period a year ago.

Several factors made for this success. Many of the Board's salesmen now work on a straight commission basis on top of a fixed salary. Their rewards are in direct proportion to their success in selling.

To enable them to concentrate on their primary task of selling, salesmen have been freed as far as possible from administrative duties, form-filling and the like.

All employees of the Board who introduce successful 'sales prospects' to the sales force now receive commission.

Finally, the Board has introduced intensive training courses in salesmanship for all directly or indirectly concerned with sales.

One salesman sold 46 cookers in a week. A maintenance worker introduced 95 successful sales prospects in the nine weeks.

CALENDAR & DIRECTORY ALTERATIONS

THE following changes have been notified. To keep the information in the 'GAS JOURNAL' Calendar and Directory up to date readers are invited to note these alterations in the Directory Section.

D32.—SHEFFIELD AND ROTHERHAM DIVISION: C. H. Plumtree, A.C.A., A.T.I.I., *not* A.S.A.A., A.T.I.I. *as printed.*

D34.—EASTERN GAS BOARD: P. Wedgwood, *Chief Chemist.*

D39.—WATFORD DIVISION: H. C. Dunbar, *Production Engineer, vice P. Wedgwood* (from February 1 last). H. Wadsworth, *Divisional Engineer, vice* W. A. Evetts (from July 1 next).

D160.—SUSSEX DIVISION SALESMAN'S CIRCLE: Arthur Bell, *Chairman.* (Mr. J. R. Simmons is *Deputy-Chairman*).

FORTHCOMING EVENTS

April 7.—NORTH OF ENGLAND SECTION, I.G.E.: 'Modern Trends in Gas Purification,' by J. J. Priestley and W. E. Bouch. 2.30 p.m.

April 8.—WALES G.C.C.: Town Hall, Aberystwyth. Council Meeting. 11 a.m.

April 8. — LONDON AND SOUTHERN JUNIORS: Westminster Technical College, Vincent Square, S.W.1. 'Quality and Cost Control on the District,' by G. H. Clegg. 6.30 p.m.

April 8.—COKE OVEN MANAGERS' ASSOCIATION, SOUTHERN SECTION: Park Hotel, Park Place, Cardiff. 'Manufacture of Di-Ammonium Phosphate,' by L. W. Stubbs.

April 9.—EAST OF SCOTLAND JUNIORS: Aberdeen. 'Gas Production,' by J. Scott.

April 13.—INSTITUTION OF PLANT ENGINEERS: Taypark Hotel, West Ferry, Dundee. 'Types and Uses of Eutectic Welding Alloys for Engineering Purposes.' 7.30 p.m.

April 14.—COMBUSTION ENGINEERING ASSOCIATION, MIDLAND REGION: The Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham, 2. 'Industrial Space Heating,' by F. R. Colton.

April 19.—LONDON AND SOUTHERN SECTION I.G.E.: The Junior Institution of Engineers, Pepys House, 14, Rochester Row, Westminster, S.W.1. 'The Hypact Burner,' by J. C. Salmon and F. C. Forder. 2.40 p.m.

April 20.—INSTITUTION OF PLANT ENGINEERS: Railway Hotel, Dartford, Kent. 'Ferrous and Non-Ferrous Welding.' 7 p.m.

GAS CENTRAL HEATING EXPERIMENTS

NEWRY (Co. Down) Urban Council Gas Committee has decided to request the town auditor to have central heating by gas installed in one dwelling as an experiment, with a view to considering this form of heating in future Urban Council housing schemes.

Mr. J. Collins, Gas Manager, said the cost of maintaining central heating would vary with different households, but he thought that on the average the annual cost would be £50 10s.

Bangor (Co. Down) Borough Council has also decided to experiment with gas central heating. Eighteen of 206 houses to be built at Skipperstone by the Council will be fitted with this form of heating, and all the houses in the estate will have grates to burn smokeless fuel.

The Council's architect reported that central heating by gas could be installed in a semi-detached house for a total of £132.